

The Secondary Stress in English: Constraints on Foot Formation*

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Over the last few decades the non-uniformity of English secondary stress has been used as the basic phenomenon for establishing new arguments about how the phonology of English should be viewed. In particular, it has been argued that this non-uniformity presents crucial evidence for the parallelism in phonology represented by Optimality Theory. This paper sets out the problems that previous OT-based analyses encounter in explaining the non-uniformity of English secondary stress and presents a new OT-based analysis of foot-formation in the secondary stress of English. The analysis proposed in this paper is distinguished from previous analyses in the following two respects. First, in the proposed analysis the interaction between the syllable-based Ft-Bin and two alignment constraints Align-L(HeavySyll, FOOT) and Align-R(HeavySyll, FOOT) is crucial to determining optimal foot-forms for the regular patterns of secondary stress in English. Second, the lexical mark, which is specified for the elements that are unexpectedly stressed or unstressed, carries the lexical foot-information of exceptional elements.

1. Introduction

Over the last few decades the non-uniformity of secondary stress in English has been used as the basic phenomenon for establishing new arguments about how the stress system of English should be viewed.¹ In particular, since the appearance of Optimality Theory (hereafter, OT) (Prince

* An earlier version of this paper was presented at the 34th annual linguistic conference at Seoul National University. Thanks to the audience and two anonymous reviewers for many helpful comments. All errors are, of course, my own.

¹ This paper allows main stress, secondary stress, and the lack of stress. Except for unstressed syllables and main-stressed syllables, all the syllables are treated as secondary-stressed ones. This follows the classification of English stress adopted in Halle and Vergnaud (1987) and Pater (1995, 1999).

and Smolensky 1993, McCarthy and Prince 1993), it has been argued that this non-uniformity presents crucial evidence for the parallelism in phonology. Some analyses within the OT framework have provided an adequate account for the metrical parsing of secondary stress that cannot be explained in the derivational model. Nevertheless, there has been disagreement among them on the controversial issues in the assignment of secondary stress in English, such as the definition of a constraint Ft-Bin and the ranking of a constraint *Weight-to-Stress Principle* (WSP) in the ranking system (Pater 1995, 1999, Alcantara 1998, Hammond 1999).

This paper presents a new OT-based analysis of the secondary stress in English. In this analysis, the following two key ideas are proposed. First, a single heavy-syllable foot in English is the result of the interaction between the *syllable-based* Ft-Bin (feet are binary under syllabic analysis) and two alignment constraints Align-L(HeavySyll, FOOT) and Align-R(HeavySyll, FOOT). In this paper, the two-way definition of Ft-Bin (feet are binary under moraic or syllabic analysis) is no longer required and the WSP constraint does not play a crucial role in assigning stress to heavy syllables in English. Second, the lexical mark, which is crucial to exceptional stress-assignment, encodes the lexical information of foot. In other words, the idiosyncratic information of foot is contained in the input of the words where stress is exceptionally assigned.

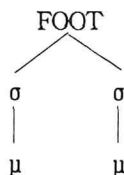
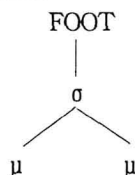
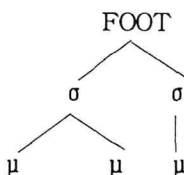
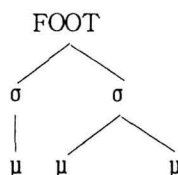
In the next section, examining four foot-forms occurring in the regular patterns of secondary stress in English, I present a single constraint-ranking system of English, which contains the ranking Align-L(HeavySyll, FOOT) » Ft-Bin » Align-R(HeavySyll, FOOT). In Section 3, I examine the exceptional patterns of secondary stress and present some evidence for the argument that the information of foot is lexically specified for some elements. For the exceptional patterns, Faith(FOOT) (the lexical information of foot is faithfully realized in the output) is added to the constraint-ranking proposed in Section 2. Section 4 ends with the conclusion of this paper.

2. English Secondary Stress: Regular Patterns

2.1. Multiple Foot-forms in English

Foot-forms in English are divided into the following four types. Here, H and L indicate a heavy syllable and a light syllable, respectively.

(1) Multiple Foot-forms in English

a. (LL)_{FOOT}b. (H)_{FOOT}c. (HL)_{FOOT}d. (LH)_{FOOT}

Since English is a trochaic system where each foot has the leftmost stress-bearing element as its head, the foot-forms in (1) are all observed in the secondary-stressed feet of the following words in (2).

(2) Examples of Multiple Foot-forms

- a. (LL)_{FOOT}: (Àpa)(làchi)[cóla (hèma)(mèli)[dánthènum
 b. (H)_{FOOT}: (bàn)[dána (Tím)(bùk)[tú
 c. (HL)_{FOOT}: (Lùxi)pa[lílla (ànti)go[nísh
 d. (LH)_{FOOT}: (sèren)[dípity (Àlex)[ánder

In the examples in (2), parentheses indicate secondary-stressed feet and a left square bracket symbolizes the left boundary of foot aligned with main stress, which will be ignored below because it is not important for the present purpose of this paper. Pater (1995, 1999) argues that feet should have binary structure composed of two moras or two syllables. In other words, the constraint Ft-Bin is defined in terms of moras or syllables, as in (3).

(3) Ft-Bin in Pater (1995, 1999)

Feet are binary under moraic or syllable analysis.

Let us consider how the constraint Ft-Bin in (3) works in the constraint-ranking system.

According to Pater (1995, 1999), Ft-Bin \gg Parse- σ , without any role of

WSP, accounts for a single heavy-syllable foot in the following types of words.²

(4) (H)_{FOOT} : Ft-Bin \gg Parse- σ

a. L + Main Stress: ba[nána]

banana	Ft-Bin	Parse- σ
a. σ ba[nána		*
b. (bà)[nána	*!	

b. H + Main Stress: (bàn)[dána]

bandana	Ft-Bin	Parse- σ
a. σ (bàn)[dána		
b. ban[dána		*!

c. LLH + Main Stress: (Hàli)(càr)[nássus]

Halicarnassus	Ft-Bin	Parse- σ
a. σ (Hàli)(càr)[nássus		
b. (Hàli)car[nássus		*!

In Pater's analysis, in order to explain the (LH)_{FOOT} foot-form composed of a single light syllable and a single heavy syllable, Parse- σ should be ranked above WSP, which requires that heavy (polymoraic) syllables are stressed. Let us consider his analysis of the words like *Àlexánder*. In the word *Àlexánder*, the obstruent-final heavy syllable (*lex*)_o is unstressed whereas the word-initial light syllable (*A*)_o is assigned secondary stress. Pater treats this secondary-stress pattern as the result of the ranking Parse- $\sigma \gg$ WSP, as illustrated in (5).

(5) (LH)_{FOOT} : Parse- $\sigma \gg$ WSP

Alexander	Parse- σ	WSP
a. σ (Àlex)[ánder		*
b. A(lèx)[ánder	*!	

WSP plays a crucial role in the account of (H)_{FOOT}(H)_{FOOT} that cannot be explained through the ranking Ft-Bin \gg Parse- σ , as shown in the tableau

² Since the constraint TROCHEE is inviolable in English, stress is always assigned to the leftmost element of every foot in English.

of the word *Tìmbùktú* in (6).

(6) (H)_{FOOT}(H)_{FOOT} : Ft-Bin \gg Parse- σ \gg WSP

	Timbuktu	Ft-Bin	Parse- σ	WSP
a. \Rightarrow	(Tìm)(bùk)[tú			
b.	(Tìmbuk)[tú			*!

Both (a) and (b) satisfy Ft-Bin and Parse- σ , but the fatal violation of WSP occurs in Form (b), where the second heavy syllable is not assigned stress. Therefore, WSP is crucial to choosing the actual form (a) as an optimal output.

According to Pater's analysis so far shown, it seems that we should agree to the argument that Ft-Bin is defined in terms of moras or syllables. If Ft-Bin is defined only in terms of moras, we would not explain the case of (5) because the actual form (*Àlex*)[*ànder* violates the mora-based Ft-Bin, and if Ft-Bin is defined only in terms of syllables, we would not explain the cases of (4) and (6) because the actual forms violate the syllable-based Ft-Bin. Furthermore, no different rankings among Ft-Bin, Parse- σ and WSP, except for Ft-Bin \gg Parse- σ \gg WSP, can account for all the actual forms so far examined.

However, a serious problem arises with this analysis. The (HL)_{FOOT} foot-form in the following words cannot be produced in this analysis.

(7) (Lùxi)pa[lílla, (Hàrde)ca[núte, (sèxa)ge[nárian, (ànti)go[nísh

When the H-L-L (Heavy-Light-Light) syllables are immediately followed by main stress, as illustrated in (7), the first H and L are together grouped within a foot but the second L is not parsed under any feet. However, the ranking Ft-Bin \gg Parse- σ \gg WSP incorrectly predicts that (H)_{FOOT}(LL)_{FOOT} should be optimal, as shown in the tableau for the word *Lùxipalílla* in (8), where the symbol \nRightarrow indicates the non-actual form which the given ranking incorrectly predicts as an optimal output.

(8) Lùxipalílla : Ft-Bin \gg Parse- σ \gg WSP

	Luxipalilla	Ft-Bin	Parse- σ	WSP
a. \Rightarrow	(Lùxi)pa[lílla		*!	
b. \nRightarrow	(Lùx)(ípa)[lílla			

While the actual form (a) fatally violates Parse- σ , the form (b) perfectly satisfies all the constraints. Therefore, the given ranking incorrectly chooses the form (b) as an optimal output. No other constraints proposed in Pater (1995, 1999) can change this result. Therefore, there is no way to choose the actual foot-form (HL)_{FOOT}L for the words like *Lùxipalilla* within Pater's framework. This means that Pater's two-way definition of Ft-Bin is not adequate to fully explain the foot-forms occurring with the various patterns of secondary stress in English.

The alternative to the two-way definition of Ft-Bin is to define Ft-Bin only in terms of syllables, as shown in (9).

(9) Ft-Bin (syllable-based definition)

Feet must be disyllabic.


According to the definition of Ft-Bin in (9), only the feet that have two syllables satisfy Ft-Bin. In 2.2, we will see the effect of syllable-based Ft-Bin.

2.2. Syllable-based Ft-Bin and Two Alignment Constraints


If Ft-Bin is defined only in terms of syllables, as defined in (9), Ft-Bin is violated by the independently footed heavy syllables (*bàn*)_σ and (*càr*)_σ in the words like *bàndána* and *Hàlicàrnássus*. Therefore, in order to assign stress to the heavy syllables (*bàn*)_σ and (*càr*)_σ in the ranking Ft-Bin \gg Parse- σ , WSP seems to be crucial, as illustrated in (10).

(10) (H)_{FOOT} : WSP, Ft-Bin \gg Parse- σ

a. H + Main Stress

	bandana	WSP	Ft-Bin	Parse- σ
a. 	bàn[dána			*
b.	ban[dána	*!		*
c.	(bàn)[dána		*!	

b. LLH + Main Stress

	Halicarnassus	WSP	Ft-Bin	Parse- σ
a. 	(Hàli)càr[nássus			*
b.	(Hàli)car[nássus	*!		*
c.	(Hàli)(càr)[nássus		*!	

Since unstressed heavy syllables violate WSP, the optimal form should be chosen between the forms with a stressed heavy syllable. Since the independently footed heavy syllables violate Ft-Bin, the unparsed but stressed heavy syllables are chosen as optimal forms in (10).

However, this analysis is not perfect for the following reason. Except for these cases, English words have stressed elements within feet. In fact, since stress is the result of prominence between elements within a foot, the forms with a parsed and stressed heavy syllable should be more optimal than the forms with an unparsed but stressed heavy syllable. Therefore, if an analysis is able to choose the forms with a parsed and stressed heavy syllable (*bàn*)[*dána* and (*Hàli*)(*càr*)[*nássus* as optimal outputs, it would be better than the analysis presented in (10).

One could argue that the ranking WSP, Parse- σ \gg Ft-Bin correctly chooses (*bàn*)[*dána* and (*Hàli*)(*càr*)[*nássus* as optimal outputs, as demonstrated in (11).

(11) WSP, Parse- σ \gg Ft-Bin

bandana	WSP	Parse- σ	Ft-Bin
a. <i>bàn</i> [<i>dána</i>		*!	
b. \varnothing (<i>bàn</i>)[<i>dána</i>			*

Halicarnassus	WSP	Parse- σ	Ft-Bin
a. (<i>Hàli</i>) <i>càr</i> [<i>nássus</i>		*!	
b. \varnothing (<i>Hàli</i>)(<i>càr</i>)[<i>nássus</i>			*

The forms with an unparsed but stressed syllable in (11a) are eliminated because they fatally violate Parse- σ ranked above Ft-Bin. However, the problem with this view is that the stress system of English does not allow the ranking WSP, Parse- σ \gg Ft-Bin. Consider the following two words.

(12) *banána* *Lùxipalílla*

If Parse- σ is ranked above Ft-Bin, the words in (12) should be *bánána* and *Lùxipàlilla* because Parse- σ is satisfied with an independently footed light syllable and the violation of the lower ranked constraint Ft-Bin is trivial, as shown in (13).

(13) WSP, Parse- σ \gg Ft-Bin

banana	WSP	Parse- σ	Ft-Bin
a. σ ba(nána)		*!	
b. σ (bà)(nána)			*

Luxipalilla	WSP	Parse- σ	Ft-Bin
a. σ (Lùxi)pa[lilla]		*!	
b. σ (Lùxi)(pà)[lilla]			*

This means that the ranking WSP, Parse- σ \gg Ft-Bin is not a proper supplementary device for explaining the perfect foot-formation and stress-assignment of heavy syllables.

Instead of treating stressed heavy syllables as the direct result of WSP, I argue that they should be treated as the result of aligning the edge of heavy syllable with the edge of foot. In other words, I propose that WSP should be replaced with the following two alignment constraints in the system of metrical parsing.

- (14) a. Align-L(HeavySyll, FOOT) (Al-L(H, FT)): every heavy syllable is aligned at its left edge with the left edge of some foot.
 b. Align-R(HeavySyll, FOOT) (Al-R(H, FT)): every heavy syllable is aligned at its right edge with the right edge of some foot.

These two constraints are coherent to Align-L(FT, PrWD) and Align-R(FT, PrWD) in that all of them specify the relation of alignment between a prosodic unit and its immediately higher prosodic unit.

Before considering how the alignment constraints in (14) replace WSP, let us briefly sketch the effect of Align-L(FT, PrWD) and Align-R(FT, PrWD) in the stress system of English. The following words are typical examples of the words in which only the light syllables are followed by main stress:

- (15) a. (Tàta)ma[góuch
 b. (àpa)(làchi)[cóla

In (15a), a disyllabic foot is aligned at its left edge with the left of the word and the third light syllable is unparsed. As shown in (16), where Ft-Bin and Parse- σ are not indicated (Ft-Bin \gg Parse- σ), this foot formation is explained by the ranking Align-L(FT, PrWD) \gg Align-R(FT, PrWD), where Align-L(FT, PrWD) is fully satisfied only if there is a single

foot at the left edge and Align-R(FT, PrWD) is fully satisfied only if there is a single foot at the right edge.

(16) LLL + Main Stress: Align-L(FT, PrWD) \gg Align-R(FT, PrWD)

	Tatarnagouch	Align-L(FT, PrWD)	Align-R(FT, PrWD)
a. ☞	(Tàta)ma[góuch		**
b.	Ta(tàrna)[góuch	*!	*

The word (*àpa*)(*làchi*)[*cóla* in (15b) shows that Parse- σ should be ranked above Align-L(FT, PrWD) because the multiple feet preceding main stress are due to the demand of Parse- σ . The following tableau illustrates the effect of the ranking Parse- σ \gg Align-L(FT, PrWD).

(17) LLLL + Main Stress: Parse- σ \gg Align-L(FT, PrWD)

	apalachicola	Parse- σ	Align-L(FT, PrWD)
a. ☞	(àpa)(làchi)[cóla		**
b.	(àpa)lachi[cóla	*!*	

Therefore, the words like (*Tàta*)ma[góuch and (*àpa*)(*làchi*)[*cóla* show that the stress system of English has the following partial ranking:

(18) Ft-Bin \gg Parse- σ \gg Align-L(FT, PrWD) \gg Align-R(FT, PrWD)

Now returning back to the other foot-forms, let us consider how the alignment constraints in (14) replace WSP in the analysis with the syllable-based Ft-Bin. First, in order to explain the (H)_{FOOT} foot-form, at least one of the alignment constraints in (14) should be ranked above Ft-Bin because this foot-form violates Ft-Bin. Here, for the moment, let us assume that the alignment constraints in (14) are both ranked above Ft-Bin. The following tableaux illustrate the effect of these alignment constraints in the words like *bàndána* and *Hàlicàrnássus*.

(19) (H)_{FOOT} : Al-L(H, FT), Al-R(H, FT) \gg Ft-Bin (Preliminary)

a. H + Main Stress: (*bàn*)[*dána*

	bandana	Al-L(H, FT)	Al-R(H, FT)	Ft-Bin
a. ☞	(bàn)[dána			*
b.	ban[dána	*!	*	
c.	bàn[dána	*!	*	

b. LLH + Main Stress: (Hàli)(càr)[nássus

Halicarnassus	Al-L(H, FT)	Al-R(H, FT)	Ft-Bin
a. ☞ (Hàli)(càr)[nássus			*
b. (Hàli)car[nássus	*!	*	
c. (Hàli)càr[nássus	*!	*	

Since unparsed heavy syllables violate Al-L(H, FT) and Al-R(H, FT) that are both ranked above Ft-Bin, the forms with a parsed heavy syllable, though violating Ft-Bin, are selected as optimal outputs.

What we consider next is about the (HL)_{FOOT} foot-form that is found in the words like (Scàndi)[návia and (Lùxi)pa[lílla. This (HL)_{FOOT} foot-form clearly shows that the ranking among Al-L(H, FT), Al-R(H, FT) and Ft-Bin should be Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT). If Al-R(H, FT) would be ranked above Ft-Bin as in (19), the foot-forms could be like *(Scàn)di[návia and *(Lùx)(ipa)[lílla because the ranking Al-L(H, FT), Al-R(H, FT) \gg Ft-Bin always prefers the (H)_{FOOT} foot-form to the (HL)_{FOOT} foot-form. On the other hand, the ranking Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT) correctly selects (Scàndi)[návia and (Lùxi)pa[lílla as optimal outputs, as illustrated in (20).

(20) (HL)_{FOOT} : Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT) (Final)

a. HL + Main Stress: (Scàndi)[návia

Scandinavian	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞ (Scàndi)[návia			*
b. (Scàn)di[návia		*!	

b. HLL + Main Stress: (Lùxi)pa[lílla

Luxipalilla	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞ (Lùxi)pa[lílla			*
b. (Lùx)(ipa)[lílla		*!	

In each pattern in (20), Form (b) violates Ft-Bin that is ranked above Al-R(H, FT). Therefore, this ranking correctly selects Form (a) that, though violating Al-R(H, FT), satisfies Ft-Bin. This ranking also correctly selects optimal outputs in the feet composed of a single heavy syllable and thus does not change the result in (19), as shown in (21).

(21) (H)_{FOOT} : Al-L(H, FT) » Ft-Bin » Al-R(H, FT)

a. H + Main Stress: (bàn)[dána]

bandana	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞ (bàn)[dána]		*	
b. ban[dána]	*!		*
c. bàn[dána]	*!		*

b. LLH + Main Stress: (Hàli)(càr)[nássus]

Halicarnassus	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞ (Hàli)(càr)[nássus]		*	
b. (Hàli)car[nássu]	*!		*
c. (Hàli)càr[nássus]	*!		*

This ranking also has no problem in choosing optimal forms in the words where two heavy syllables are immediately followed by main stress, as shown in (22).

(22) HH + Main Stress: Al-L(H, FT) » Ft-Bin » Al-R(H, FT)

Timbuktú	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞ (Tim)(bùk)[tú]		**	
b. (Timbuk)[tú]	*!		*

In replacing WSP with Al-L(H, FT) and Al-R(H, FT), it should be noted that stress is assigned in the trochaic way in English. If stress is assigned in the iambic way, Al-R(H, FT) cannot be ranked lower than Al-L(H, FT) and Ft-Bin because the leftmost heavy syllable of a foot resulting from Al-L(H, FT) » Ft-Bin » Al-R(H, FT) cannot be assigned stress in the iambic system. In other words, while Al-L(H, FT) is more active than Al-R(H, FT) in the trochaic system of English, Al-R(H, FT) is more active than Al-L(H, FT) in the iambic system. This means that the assignment of stress to heavy syllables is the reflection of stress system.

However, there is a case that seems to be a counter-example against this analysis. That is an (LH)_{FOOT} foot-form, where a single light syllable is followed by a single heavy syllable, as in the words like (Àlex)[ándér. Recall that in the analysis proposed in Pater (1995, 1999), in order to explain this foot-form, WSP is ranked below Parse-σ, as repeated in (23).

(23) (LH)_{FOOT} : Parse-σ » WSP

Alexander	Parse-σ	WSP
a. ☞ (Àlex)[ándér		*
b. A(lèx)[ándér	*!	

It seems that the ranking Al-L(H, FT) » Ft-Bin » Al-R(H, FT) cannot explain the (LH)_{FOOT} foot-form in this case, as shown in (24).³

(24) (LH)_{FOOT} : Al-L(H, FT) » Ft-Bin » Al-R(H, FT)

Alexander	Al-L(H,FT)	Ft-Bin	Al-R(H,FT)
a. ☞ (Àlex)[ándér	*!		
b. ☞ A(lèx)[ándér		*	

While the actual form (Àlex)[ándér fatally violates Al-L(H, FT), the incorrect form A(lèx)[ándér does not violate Al-L(H, FT) even though it violates Ft-Bin. Therefore, the incorrect form A(lèx)[ándér is chosen as an optimal output by this ranking. This seems to mean that the ranking Al-L(H, FT) » Ft-Bin » Al-R(H, FT) has a fatal defect. However, this is not the case.

It should be noted that the (LH)_{FOOT} foot-form occurs only in the word-initial sequence of light and heavy syllables that is immediately followed by main stress. Consider the following words.

- (25) a. Hà-li-càr-[nássus
 L L H
 b. Buè-na-vèn-[túra
 H L H
 c. Mo-nòn-ga-[héla
 L H L

The L-H sequence occurs word-medially in (25a, b) and it is not immediately followed by main stress in (25c) though it occurs word-initially. In these cases, the L-H sequence cannot form an independent foot. In other words, the L and H cannot be grouped together within the same foot. This is clearly supported by the fact that in contrast to the H in

³ One can argue that the actual form is selected as an optimal output if Parse-σ is ranked above Al-L(H, FT). However, this is not the case because Parse-σ should be ranked below Al-L(H, FT) in this ranking system. See the case of (Lùxi)pa[lílla in (20b), adding Parse-σ to the ranking.

(*Àlex*)/[*ánder*, the H of L-H sequence in (25) is assigned stress. The foot-formation and secondary-stress assignment of the words in (25) are correctly predicted by the ranking Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT). The account of (*Hàli*)(*càr*)/[*nássus* by this ranking has been demonstrated in (21b) and the tableaux in (26) demonstrate how this ranking explains (*Buè*)na(vèn)/[*túra* and Mo(nònga)/[*héla*.

(26) a. H-L-H + Main Stress

Buenaventura	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ⚡(Buè)na(vèn)/[túra		**	
b. (Buè)(nàven)/[túra	*!	*	

b. L-H-L + Main Stress

Monongahela	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ⚡Mo(nònga)/[héla			*
b. (Mònon)ga/[héla	*!		

Now, an important question arises concerning the (LH)_{FOOT} foot-form in the words like (*Àlex*)/[*ánder*: why is the (LH)_{FOOT} foot-form in English allowed only if it occurs word-initially and is immediately followed by main stress? A clue is given in relation to the upbeat pattern of stress. For the moment, let us assume that the (LH)_{FOOT} foot-form does not occur in that environment (*word-initial* and *immediately followed by main stress*). The non-occurrence of (LH)_{FOOT} foot-form would result in the upbeat pattern of NONSTRESS-SECONDARY STRESS-MAIN STRESS in the word-initial position, as in *A(lèx)/[*ánder*. I argue that the upbeat pattern of stress is not allowed in the word-initial position in English:

(27) a. Upbeat Pattern of Stress

NONSTRESS-SECONDARY STRESS-MAIN STRESS

b. Prohibition of Word-initial Upbeat in English

*#UpBeat

As shown in (25a, b), English allows the upbeat pattern of stress in other environments. Therefore, we must figure out a constraint to prohibit the upbeat pattern from occurring word-initially in English. Without abandoning the ranking Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT), I propose the following anti-alignment constraint:

- (28) No-Align-L(UPBEAT, PrWD)⁴ (No-Al-L(UPBEAT, PrWD))

UPBEAT is not aligned at its left edge with the left edge of some prosodic word.

The ranking No-Al-L(UPBEAT, PrWD) \gg Al-L(H, FT) easily accounts for the word-initial (LH)_{FOOT} form in the words like *A(lèx)/ándér*:

- (29) No-Al-L(UPBEAT, PrWD) \gg Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT)⁵

Alexander	No-Al-L (UPBEAT, PrWD)	Al-L (H, FT)	Ft-Bin	Al-R (H, FT)
a. \square (Àlex)[ándér		*		
b. A(lèx)[ándér	*!		*	

Form (b) fatally violates No-Al-L(UPBEAT, PrWD) because the upbeat pattern of stress occurs word-initially. The actual form (a), though violating Al-L(H, FT), is correctly selected as an optimal output because it does not have the word-initial upbeat.

Furthermore, no change is made by adding No-Al-L(UPBEAT, PrWD) to the ranking Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT) in the selection of optimal outputs of words in (25) because no actual forms of the words violate No-Al-L(UPBEAT, PrWD). Therefore, we conclude that the ranking No-Al-L(UPBEAT, PrWD) \gg Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT) is crucial to the foot formation and stress assignment in the secondary stress system of English and that the stress system of English has the following partial ranking.

- (30) No-Al-L(UPBEAT, PrWD), NoMono- μ Ft \gg Al-L(H, FT) \gg Ft-Bin
 \gg Al-R(H, FT), Parse- σ \gg Align-L(FT, PrWD) \gg Align-R(FT, PrWD)
 (see FOOTNOTE (5) for NoMono- μ Ft)

In the next section, we discuss the treatment of exceptional cases.

⁴ The downbeat pattern of MAIN STRESS-SECONDARY STRESS-NONSTRESS is not allowed word-finally in English. In this respect, No-Align-R(DOWNBEAT, PrWD) also plays a crucial role in the stress assignment in English.

⁵ One can argue that according to the given ranking, one possible candidate *(À)/lèx)/ándér* should be more optimal than the actual output *(À)lex)/ándér*. However, the constraint NoMono- μ Ft (No foot is mono-moraic), which is not indicated in the tableau but ranked above Al-L(H, FT), prohibits *(À)/lèx)/ándér* from being an optimal output.

3. English Secondary Stress: Exceptional Patterns

The analysis proposed in Section 2 accounts for the regular patterns of secondary stress in English. However, there are some exceptional patterns of secondary stress that are recalcitrant in the proposed ranking system. The following words are typical examples for these exceptional patterns.

- (31) a. *plâteáu* *pàróusia*
 (Compare them with *banána*)
 b. *Kilimanjáro* *Nèbuchadnézzar*
 (Compare them with *Hàlicàrnássus*)

In (31a), the words *plâteáu* and *pàróusia* are exceptional because in contrast to the regular-patterned words like *banána*, the initial light syllable immediately followed by main stress is assigned secondary stress. The words *Kilimanjáro* and *Nèbuchadnézzar* in (31b) are also exceptional in that the medial heavy syllables are unstressed whereas the regular-patterned words with the same structure, like *Hàlicàrnássus*, surface with stressed medial heavy syllables. Without any additional device, therefore, these exceptional patterns are difficult to explain.⁶

In order to explain these exceptional patterns, Hammond (1999) adopts a theory of lexical accent, whereby certain elements are lexically marked to attract stress. According to Hammond's (1999) proposal, the accent-mark notated with a raised circle is lexically specified for the element that cannot be assigned stress by the normal metrical parsing. Stress is assigned to that element by the constraint Faith(♂), which requires that lexically marked elements surface with stress. This approach is illustrated by the following tableau of *plâteáu*.

⁶ Pater (1995, 1999) argues that in order to satisfy STRESSWELL which forces a stressed syllable not to be adjacent to main stress, the medial heavy syllable in the words like *Kilimanjáro* surfaces as a light syllable where the syllabic consonant is its head and is not assigned stress ((*man*)_σ to (*mn*)_σ in *Kilimanjáro*). In this view, however, we cannot account for why the medial heavy syllable in the words like *Hàlicàrnássus* is still assigned stress and why it does not surface as a light syllable where syllabic consonant *r* is its head. Furthermore, the medial heavy syllable in *Nèbuchadnézzar* is unstressed even though it contains a non-syllabic consonant *d*. Since WSP is ranked above STRESSWELL in Pater's analysis, stress should be assigned to the medial heavy syllable (*chad*)_σ that cannot surface as a light syllable.

(32) Hammond’s (1999) Approach to Exceptional Patterns

	plâteau	Faith(ϕ̂)	Ft-Bin
a.	ϕ̂ (plà)[teáu		*
b.	pla[teáu	*!	

Form (a), though violating Ft-Bin, satisfies the higher-ranked constraint Faith(ϕ̂) and Form (b) fatally violates it. Therefore, the exceptional but actual form (plà)[teáu is chosen as an optimal output.

While this approach is successful in the words like *plâteáu* and *pàrousia* where light syllables are unexpectedly assigned stress, it fails to treat other exceptional patterns because it excessively produces lexically marked elements, most of which can be regularly assigned stress within the normal ranking system without any lexical accent-mark and Faith(ϕ̂). For instance, in Hammond (1999) the lexical accent-mark is used to explain the stress patterns of the following words that are easily explained by the constraint ranking proposed in this paper.

(33) ACTUAL FORMS	LEXICAL MARKS
a. bândána	bândana
b. Hàlicárnássus	Halicárnassus
c. òmbùktú	òmbùktu

In the words in (33), every secondary-stressed heavy syllable has a lexical accent-mark within Hammond’s framework. However, as demonstrated in 2.2, these syllables are regularly assigned stress by the constraint-ranking proposed in this paper (see (21) and (22)). In Hammond (1999), WSP (Al-L(H, FT) and Al-R(H, FT) in this paper) plays no role in these cases because it actually overlaps with Faith(ϕ̂) in its function.

Here, we should consider why the words in (33) should have lexical accent-marks within Hammond’s framework. The function of lexical accent-mark and Faith(ϕ̂) is to assign unexpected stress to the syllables that cannot be assigned stress in the normal process. However, they cannot play any role in unstressing the syllables that should normally be assigned stress, as shown in the words like *Kilimanjáro* and *Nèbuchadnézzar*. In Hammond (1999), therefore, while the stress pattern of these words is treated as a regular one, the regular stress pattern of the words in (33) is treated as an exceptional one with a lexical accent-mark. This treatment results in a serious problem because regular patterns are treated as

exceptional. This is due to the inadequacy of lexical information carried by the lexical accent-mark. In fact, we need the lexical information for both unexpectedly stressed and unexpectedly unstressed syllables whereas the lexical accent-mark in Hammond (1999) carries the lexical information only for unexpectedly stressed syllables.

In this paper, instead of a theory of lexical accent, I adopt a theory of lexical foot-boundary, in which some elements have specific information of lexical foot (Idsardi 1992, Halle and Idsardi 1995, Kim 1999, 2000a, b). In other words, some elements are lexically marked in terms of the information of foot. The boundaries notated with normal left and right parentheses are lexically specified for the elements that should be a member of foot (*lexically metrical*) and the boundaries notated with left and right angle brackets are lexically specified for the elements that cannot be a member of foot (*lexically extra-metrical*).⁷

Faith(FOOT) requires that the lexical information of foot is faithfully realized in the output. Now let us see how this approach explains the exceptional patterns of secondary stress in the words in (31) repeated here as (34).

- (34) a. plâteáu pàróusia
 b. Kilimanjáro Nèbuchadnézzar

The following information is stored for the words *plâteáu* and *pàróusia* in the lexicon.

- | | |
|-------------------|---------------|
| (35) ACTUAL FORMS | LEXICAL MARKS |
| plâteáu | (pla)teau |
| pàróusia | (pa)rousia |

The ranking Faith(FOOT) \gg Ft-Bin explains the stress pattern of these words, as shown in (36).⁸

⁷ In the literature of metrical parsing, the angle brackets are normally used for an extra-metrical element in the word-final position. Here, the lexical angle brackets are used for the elements that are lexically extra-metrical.

⁸ Faith(FOOT) should be ranked higher than NoMono- μ Ft in order for the lexically marked light syllable to independently form a single foot.

(36) Lexical Foot Approach to Exceptional Patterns

	(pà)teau, (pà)rousia	Faith(FT)	Ft-Bin
a. ☞	(pà)[teáu		*
b.	plafteáu	*!	
a. ☞	(pà)[róusia		*
b.	pa[róusia	*!	

This approach is similar to Hammond's approach in the treatment of this type of exceptional pattern. However, it is distinguished from Hammond's approach in the treatment of the words in (34b). The following information is stored for the words *Kilimanjaro* and *Nèbuchadnézzar* in the lexicon.

(37) ACTUAL FORMS	LEXICAL MARKS
Kilimanjaro	Kili<man>jaro
Nèbuchadnézzar	Nebu<chad>nezzar

The angle-bracketed syllables are lexically marked as the elements that cannot be a member of foot. Therefore, the ranking Faith(FOOT) \gg Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT) makes these syllables unparsed, as illustrated in (38) and (39).

(38) Kilimanjaro: Faith(FT) \gg Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT)

	Kili<man>jaro	Faith(FT)	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞	(Kili)mn[járo				
b.	(Kili)man[járo		*!		*
c.	(Kili)(màn)[járo	*!		*	

(39) Nèbuchadnézzar: Faith(FT) \gg Al-L(H, FT) \gg Ft-Bin \gg Al-R(H, FT)

	Nebu<chad>nezzar	Faith(FT)	Al-L(H, FT)	Ft-Bin	Al-R(H, FT)
a. ☞	(Nèbu)chad[nézzar		*		*
b.	(Nèbu)(chàd)[nézzar	*!		*	

Since the medial heavy syllables in (38) and (39) are lexically marked as the elements that cannot be a member of foot, Faith(FOOT) forces these syllables to be unparsed. Therefore, the ranking given in (38) and (39) chooses the actual forms *(Kili)mn[járo* and *(Nèbu)chad[nézzar* as optimal outputs. In particular, it should be noted that the actual form in (38a) contains a light syllable with a syllabic consonant. If the syllable surfaces

as a heavy syllable, the form would violate Al-L(H, FT) and Al-R(H, FT) . Therefore, this ranking system clearly shows why the lexically heavy syllable $(man)\sigma$ surfaces as a light syllable $(mn)\sigma$ in *Kilimanjaro*. Since the medial heavy syllable in (39) does not contain any syllabic consonant, there is no way to surface as a light syllable.

We summarize now the points proposed in this section. We have observed the exceptional patterns of secondary stress that are recalcitrant without adding additional device to the normal constraint-ranking system: unexpected stress in light syllables and unexpected non-stress in heavy syllables. In order to treat these exceptional patterns, I have proposed that the information of foot is lexically specified for some elements and Faith(FOOT) should be added to the constraint-ranking given in (30).

4. Conclusion

In closing this paper, we should summarize the ranking system in English. First, we have observed that the two-way definition of Ft-Bin is not useful in explaining the secondary stress system of English because the ranking system with the two-way definition of Ft-Bin cannot fully cover the various patterns of secondary stress in English. Second, we have also observed that stressed heavy syllables should not be treated as the direct result of WSP because the syllable-based Ft-Bin and WSP cannot produce perfect foot-forms for stressed heavy syllables: the syllable-based Ft-Bin and WSP prefer the unparsed but stressed heavy syllable *bân/dána* to the parsed and stressed heavy syllable *(bân)/dána*. Third, as an alternative, we have proposed, with the syllable-based Ft-Bin , two alignment constraints in terms of the prosodic relation between heavy syllables and feet: Al-L(H, FT) and Al-R(H, FT) . Fourth, by using $\text{No-Align-L(UPBEAT, PrWD)}$ we have explained the word-initial marked foot pattern $(\text{LH})_{\text{FOOT}}$ followed by main stress and we have observed that the ranking $\text{No-Align-L (UPBEAT, PrWD), NoMono-}\mu\text{Ft} \gg \text{Align-L(HeavySyll, FOOT)} \gg \text{Ft-Bin} \gg \text{Align-R(HeavySyll, FOOT)}$ correctly selects actual forms as optimal outputs in regular patterns. Finally, in the last section, we have observed that the inviolable Faith(FOOT) is needed in the stress system of English.

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